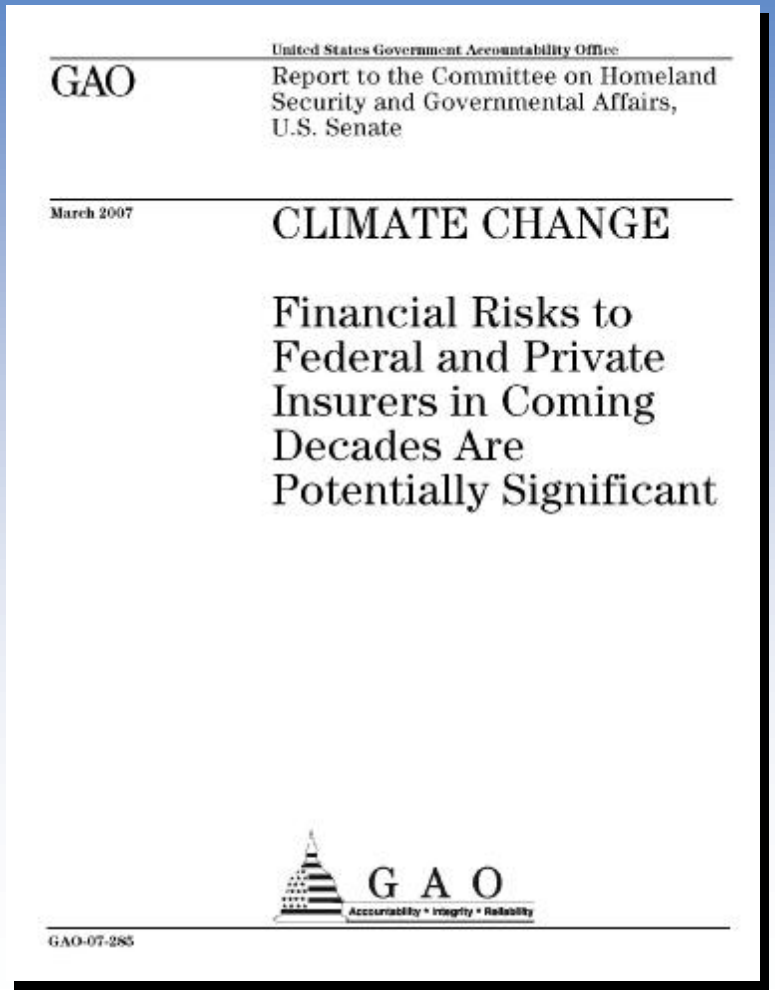
FEMA Climate Change & Coastal Studies Project:

Bo Juza PhD, CFM - NSP
Mark Crowell - FEMA HQ

Impact of Climate Change on the NFIP

- GAO Report, released March 2007
- Report recommends FEMA analyze impact of climate change on the NFIP



United States Government Accountability Office

GAO

Report to the Committee on Homeland Security and Governmental Affairs, U.S. Senate

March 2007

CLIMATE CHANGE

Financial Risks to Federal and Private Insurers in Coming Decades Are Potentially Significant

GAO

Accountability • Integrity • Reliability

GAO-07-285

GAO recommendations

- We recommend that the Secretary of Agriculture and the Secretary of Homeland Security direct the Administrator of the Risk Management Agency and the Under Secretary for Emergency Preparedness to analyze the potential long-term implications of climate change for the Federal Crop Insurance Corporation and the National Flood Insurance Program and report their findings to the Congress. This analysis should use forthcoming assessments from the Climate Change Science Program and the Intergovernmental Panel on Climate Change to establish sound estimates of expected future conditions.

GAO recommendations cont.

- Key components of this analysis may include: (1) realistic scenarios of future losses under anticipated climatic conditions and expected exposure levels, including both potential budgetary implications and consequences for continued operation, and (2) potential mitigation options that each program might use to reduce their exposure to loss.

GAO Recommendations

- Addressed “Climate Change” in General terms, thereby implying that FEMA analyze changes in:
  - Precipitation patterns
  - Frequency and intensity of coastal storms
  - Sea level rise

According to the CCSP

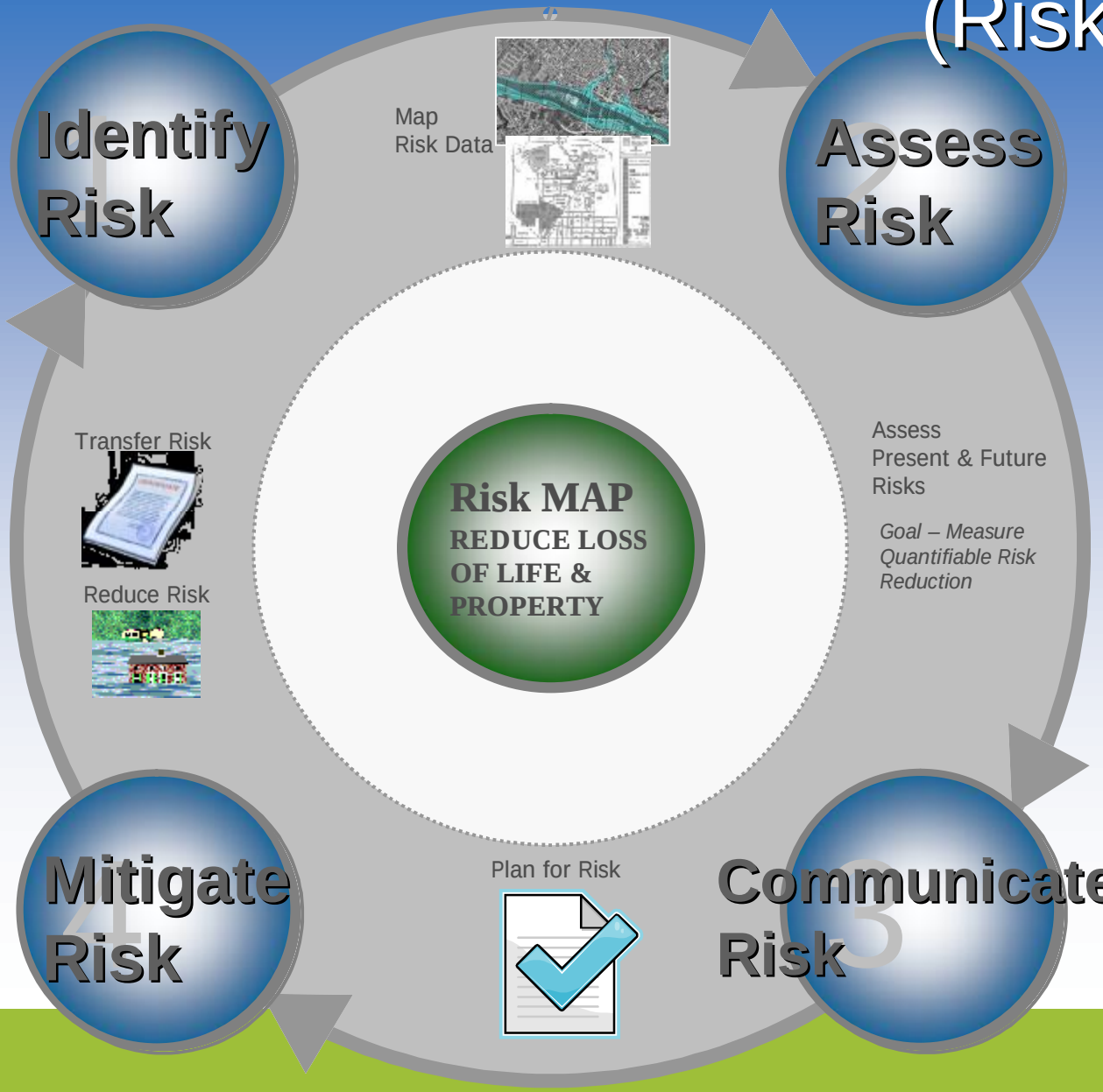
- Expectations of Climate change impact over the next 100 years
  - Precipitation expected to be less frequent but more intense
  - Global sea levels will rise between 7 and 23 inches by 2099 (from IPCC (Intergovernmental Panel on Climate Change))
  - Storm surge expected to increase due to SLR
  - Hurricane intensity likely to increase
  - Less confidence in projected changes in number of hurricanes

Study Background

- Three issues have come up that question methods used by FEMA to administer certain aspects of the NFIP. The issues are:

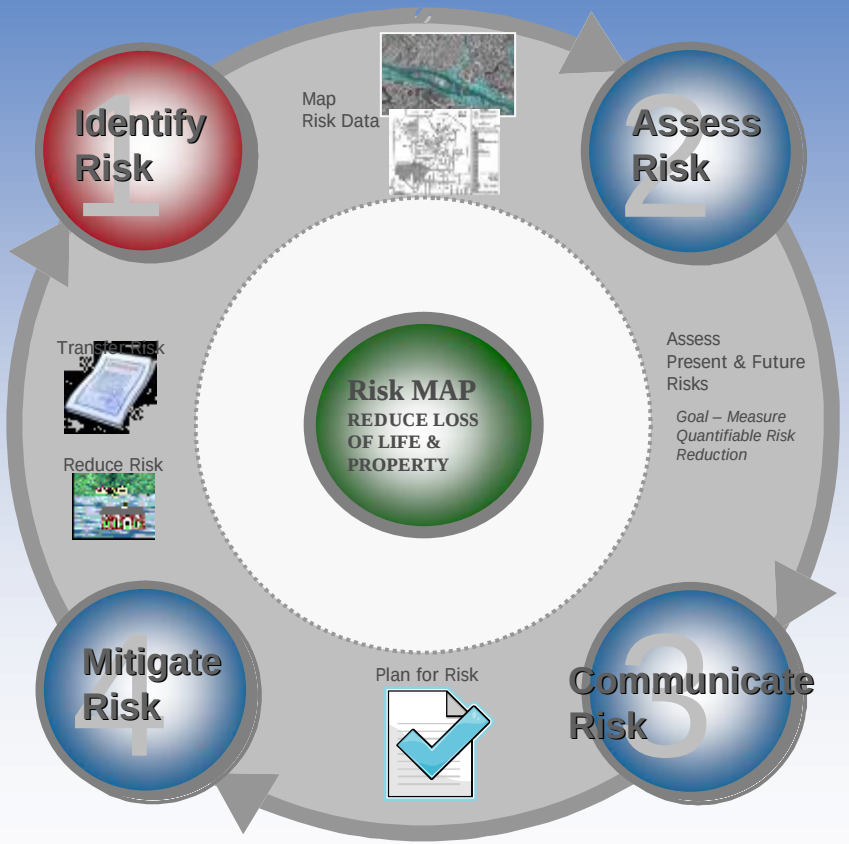
1. Impact of climate change on the NFIP
2. Use of the Primary Frontal Dune as a factor in delineating V-Zones
3. Coastal A Zone problem

Risk Mapping, Assessment, and Planning (Risk MAP)



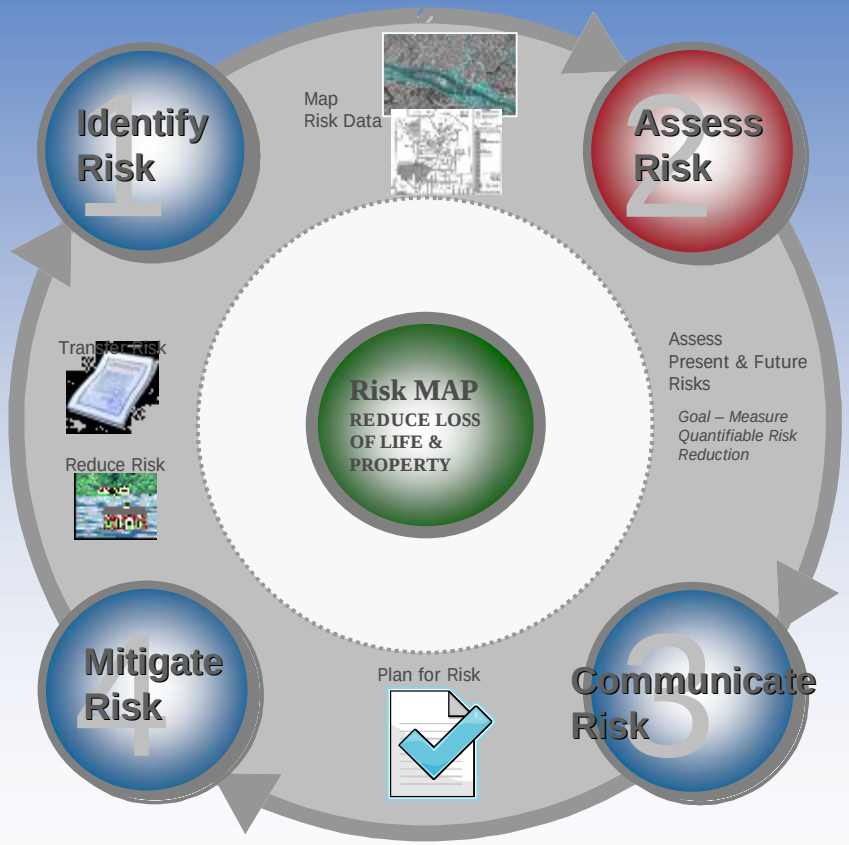
Identify Risk

- Coastal
- Areas behind levees
- Other riverine flood hazards
- How we prioritize our investments:
  - Physical changes
  - Climatological changes
  - Methodological changes



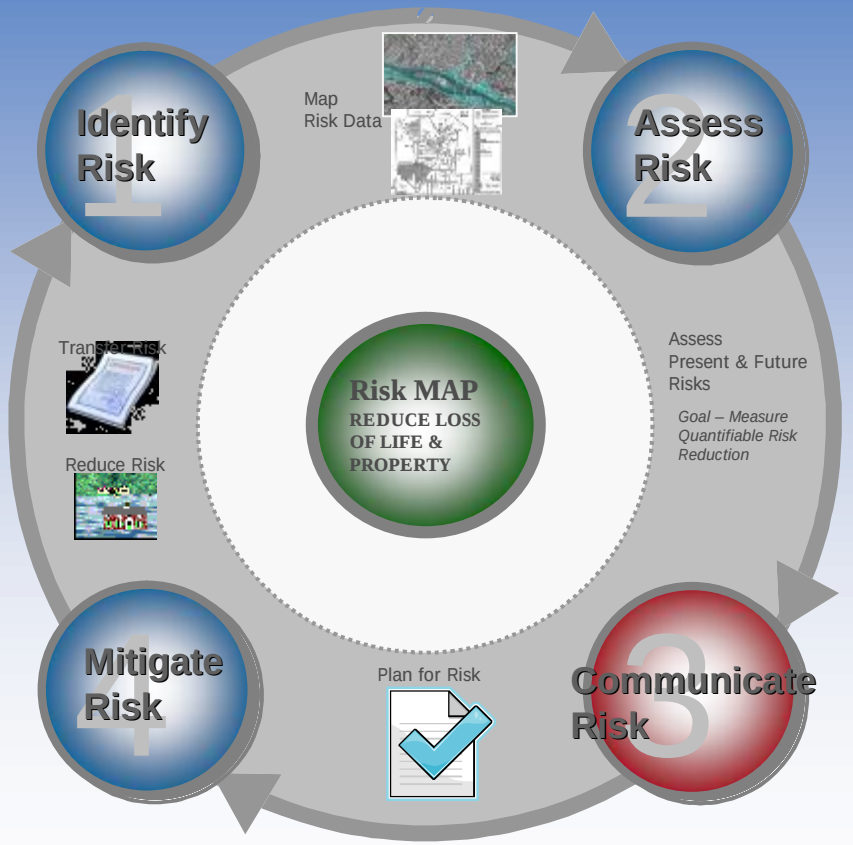
Assess Risk

- National flood loss study
- Acceptable methodologies
- Improved accessibility to flood hazard data
- Improved risk communication



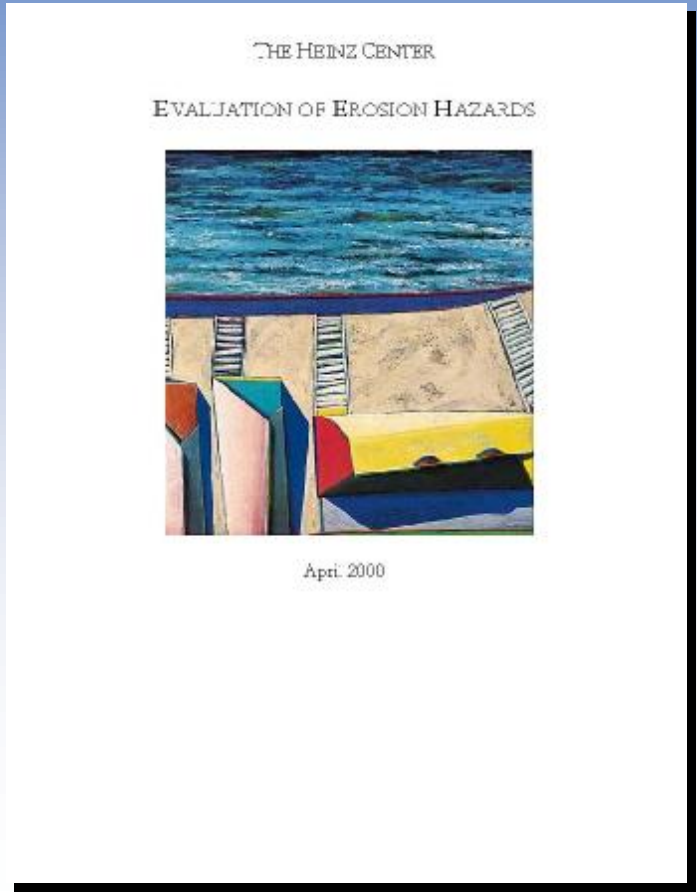
Communicate Risk

- Accessible and usable tools to compliment local activities
- Utilization of updated State, local, and Tribal mitigation planning guidance
- Demonstrate progress in planning process
- Leverage planning process to better communicate risk
- Enhancements in technology



Previous Climate Change and Long-Term Erosion Studies

- 1988: Upton/Jones Amendment
- 1990: NRC—"Managing Coastal Erosion."
- 1991 "Projected Impact of Relative Sea Level Rise on the NFIP"
- 1994: NFIRA, Sec 577 required "Evaluation of Erosion Hazards study."
- 2000: Heinz Center releases "Evaluation of Erosion Hazards" report

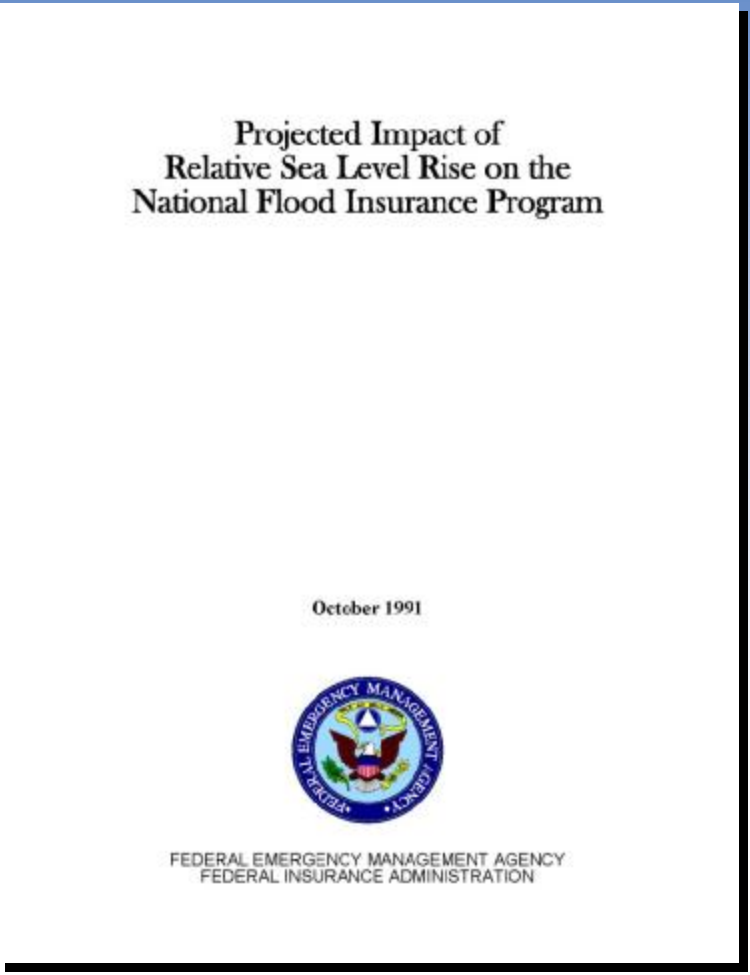


Sea Level Rise Not Directly Considered in the NFIP

- SLR considered indirectly to the extent that
  - NFIP Community Rating System gives credits towards freeboard
  - Coastal Construction Manual
  - Insurance rating—premiums are lower for elevated structures
  - Contingency loading
  - Insurance rates are increasing faster in the V Zone than they should be if strictly based on our flood risk models.

1991 Sea Level Rise Study

- Study titled: "Projected Impact of Relative Sea Level Rise on the National Flood Insurance Program"
- Mandated by Congress in 1989
- Managed by Mike Buckley & Howard Leikin
- Completed in 1991



1991 Sea Level Rise Study cont.

- Examined 3 sea level rise scenarios over period from 1990 to 2100
  - No change
  - One-foot rise over the next century
  - Three-foot rise over the next century

2008 Study Goals

- Findings, conclusions, policy options, and recommendations on if and how FEMA should make changes to the NFIP to accommodate potential impacts of climate change.
- Need to consider this with respect to:
  - Floodplain mapping
  - Floodplain management
  - Insurance
- Address recommendations made in the 2007 GAO Report.

Three Types of Analyses

- Riverine flooding
  - Effect of climate change on flood discharge
  - Consequent change of flood elevation and width
  - Includes consideration of snow melt
- Coastal Flooding
  - Relative Sea Level Rise
  - Tropical and Extratropical Storms (Gulf and Atlantic)
  - Storm Waves (Pacific and Territories)
- Catastrophic (Event-based) Modeling

Climate Change Study Objectives

- Determine Likely Changes in US Flooding
  - Extent and Severity
  - Selected time snapshots or epochs
    - 2020, 2030, … 2100
    - Or 2025, 2050, … 2100
  - Insurance / Financial Implications
- Assess Potential Mitigation Measures and Insurance Changes

Climate Change Study Assumptions

- First: No climate assessment work, as such
  - Data to be taken from IPCC, CCSP, …

- Second: Approximation is essential
  - 20,000+ Communities in the NFIP
  - New modeling is not feasible

General Approach

- Define Characteristic Regions
  - Hydrologic Factors
  - Climate Change Homogeneity
- Subdivide Regions into Units for Analysis
  - Stream Type / Stream Order
  - Coastal Uniformity (SLR, Climatology)
- Perform Climate Change / Flood Response Evaluations
  - For each Unit in each Region for each Epoch

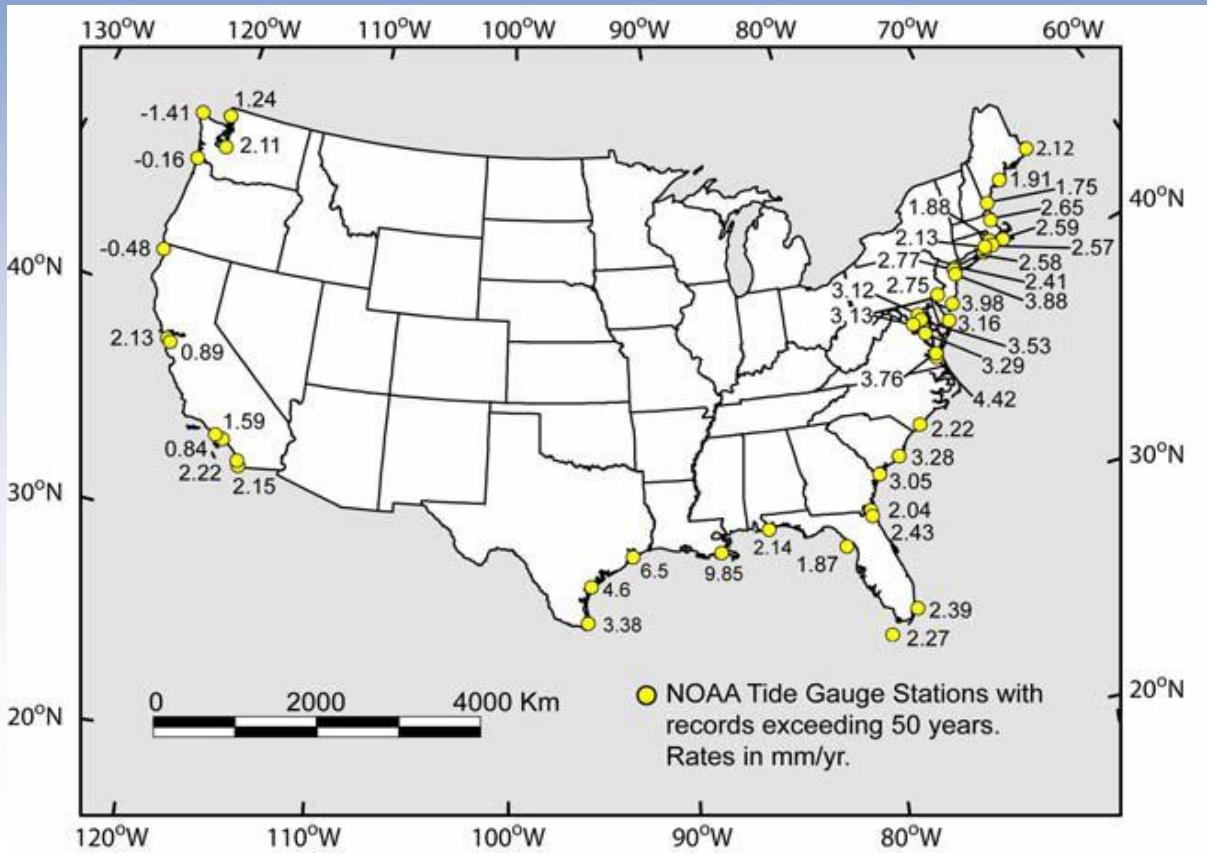
Riverine Analysis

- Identify Parameters that control runoff
  - Rainfall Frequency
  - Rainfall Intensity
  - Antecedent Moisture
  - Natural Landcover
  - Development
  - Population
  - Snow mass
  - …

NOTE: These are not necessarily independent. Dependence between parameters will be a consideration in the implementation

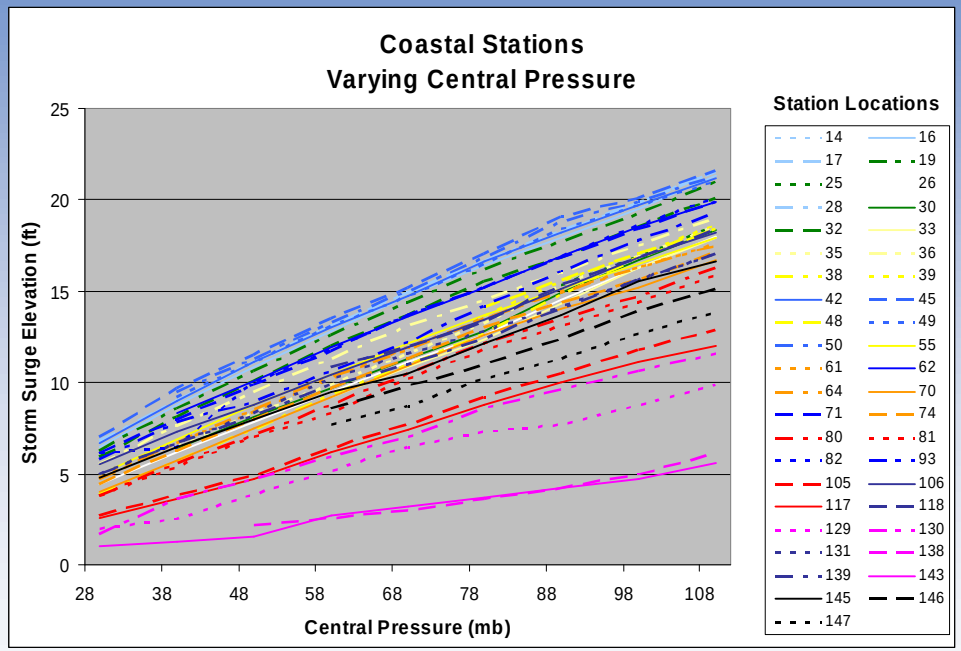
Coastal Analysis

- Relative sea level change
  - Generally smaller than storm effects and tide
  - Superposition
  - (Subsidence)



Coastal Analysis

- Tropical storm aspects
  - Major factor 1: Storm Density
    - **S** Simple Frequency Shift
  - Major factor 2: Storm Intensity
    - **S** Linear Surge Dependence



Coastal Analysis

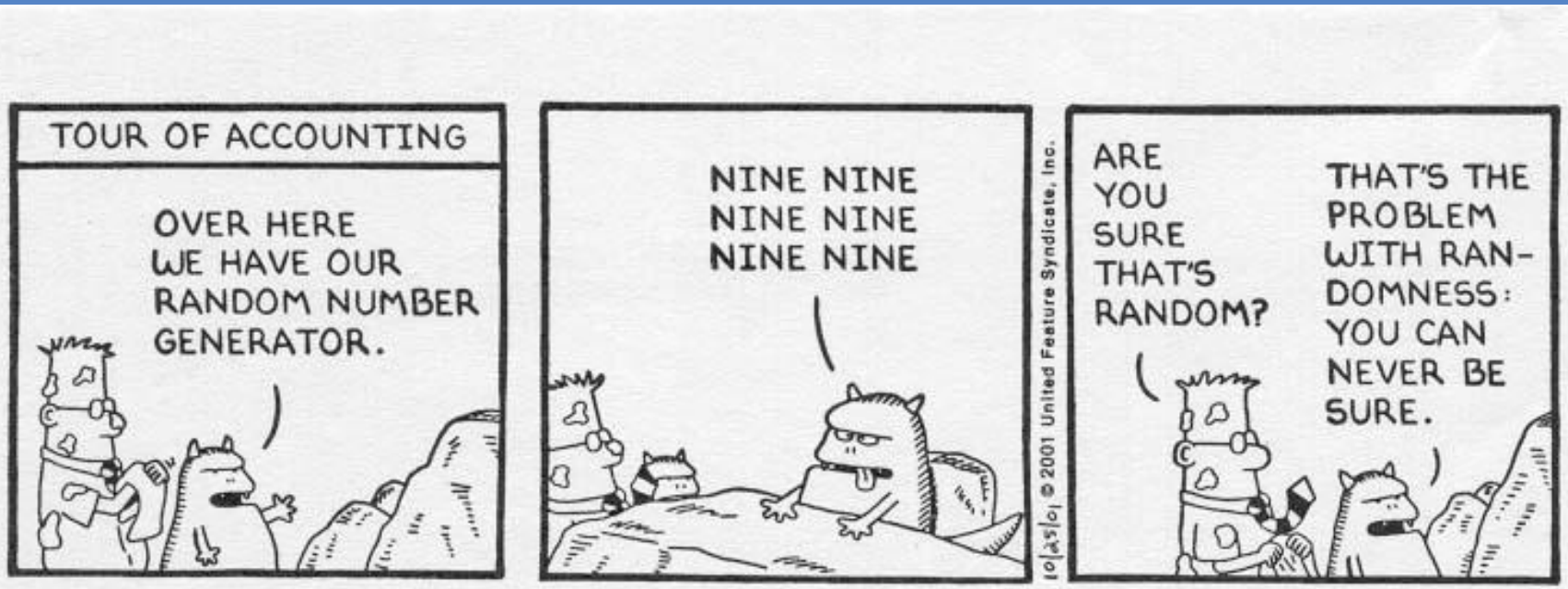
- Extratropical storms
  - Frequency Shift
  - Re-fashion EST studies

- Wind waves
  - Storm Frequency
  - Storm Intensity (wind speeds)
    - 1st Order effect on H & T
    - Implications for Runup & Overtopping

Other Considerations

- Human interventions
  - World Community response alternatives
- Tipping point issues
  - Levees
  - Alluvial fan protection
  - Coastal Dunes
- Chronic erosion

Q and A



Predictions are very difficult ...Particularly, about the ***future***" (***Niels Bohr***).